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Full Length Research Paper

Phytochemical and proximate composition of *Datura innoxia* leaf, seed, stem, pod and root

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Phytochemical and proximate analyses of *Datura innoxia* leaf, seed, stem, pod and root were carried out. Phytochemical screening result revealed the presence of atropine, scopolamine, essential oils, saponins, flavonoids, phenols, as well as cardiacs glycosides; while tannins, coumarins, carboxylic acid and valepotriates were absent in all the plant parts examined. The proximate analysis indicated significant (P < 0.05) variation in crude protein content which ranged from 2.09 in the root to 17.21%, moisture content (3.5 in root to 15% in stem), crude lipid content was 6% in root and 15.52% in the seed. Total ash was highest in the root (25.71%) and least in the seed (8.26%) while nitrogen free extract was (47.97%) and 20.88% in the pod and stem, respectively.

Key words: Phytochemical, proximate analysis, *Datura innoxia.*

INTRODUCTION

Plants, unlike animals, do not have the luxury of teeth, claws and legs to help them get out of a tight spot, most plants spend their lives in one place and have evolved to rely upon elaborate chemical defences to ward off unwanted predators. For this reason, plants have in their arsenal an amazing array of thousands of chemicals noxious or toxic to bacteria, fungi, insects, herbivores, and even humans. Fortunately, this chemical diversity also includes many compounds that are beneficial to humans: vitamins, nutrients, antioxidants, anticarcinogens, and many other compounds with medicinal value (Novak and Haslberger, 2000).

Most plants, including food plants, contain some levels of natural plant toxins. A chemist measures the levels of toxins in plant tissues to evaluate their safety for animal feed and drug. Effect of naturally-occurring plant-made toxins found at low levels in many foods and drugs that we take, on humans and animals, is based on laboratory tests using toxin concentrations much higher than the concentrations normally found in food and drug.

D. innoxia belongs to the family solanaceae, which is known for its importance as a source of drugs in medicine and pharmacology. Medicinal plants play a significant role in providing primary health care services to rural people and are used by about 80% of the marginal communities around the world (Prajapati and Prajapati, 2002; Latif et al., 2003; Shinwari et al., 2006).

Each medicinal plant species has its own nutrient composition besides having pharmacologically important photochemicals. These nutrients are essential for the physiological functions of human body. Such nutrients and biochemicals like carbohydrates, fats and proteins play an important role in satisfying human needs for energy and life processes (Hoffman et al., 1998; Mathews et al., 1999; Dingman, 2002). Compared to edible plants, the chemical composition of *D. innoxia* has been poorly investigated and most of the available information only deals with traditional and medicinal aspects. The aim of the present study was to determine the phytochemical and proximate compositions of five morphological parts of *D. innoxia; leaf*, seed, stem, pod and root in order to provide Phytochemical and nutrient information about it.

MATERIALS AND METHODS

Fresh samples of *D. innoxia* plants were collected from University of

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Agriculture, Makurdi, Benue State of Nigeria. The plants samples were separated into leaves, seeds, stems, pods and roots. These samples were air-dried to constant weight under laboratory conditions (Temperature 26°C) and ground to five powders in a clean laboratory mortar.

Proximate analyses

Moisture analysis

Moisture content was determined by using thermostat oven. Two grammes of each sample were transferred into labelled crucibles of known weights at 120°C and samples were dried to constant weight. Moisture content was expressed as percentage by weight of sample. (AOAC, 1995)

Determination of ash

The ash contents were estimated by heating the samples overnight in a furnace at 525°C (AOAC, 1995).

Extraction of crude lipids

Crude lipids were extracted from the *D. innoxia* powder samples in a soxhlet extractor with chloroform: methanol (2:1, v/v). The contents of crude lipids were determined gravimetrically after oven-drying (80°C) the extract overnight (AOAC, 1995).

Total dietary fibre analysis

The content of total dietary fibre (TDF) in *D. innoxia* (was determined according to the AOAC enzymatic-gravimetric method (AOAC, 1995). In brief, aliquots of samples (1 g of dry matter) were first treated with two amylases, for 30 min in a boiling water bath and amyloglucosidase for 30 min at 60°C to remove starch and then a protease to solubilise protein. The enzyme-treated mixture containing the buffer solution and non-digestible materials was precipitated with four volumes of absolute ethanol. Then the ethanol-insoluble residue was filtered with a fibre-tec system. The residue recovered was washed, oven-dried and weighed to give the gravimetric yield of the *D. innoxia* fibre material or TDF.

Crude protein analysis

The crude protein content was calculated by multiplying the nitrogen content, which was determined by standard procedures of AOAC (1995). Crude protein was calculated by multiplying the total nitrogen by a conversion factor of 6.25.

Phytochemical screening

Phytochemical screening of the leaf, seed, stem, pod and root for active ingredients was done using the thin layer chromatography (TLC) method. The solvent system was chloroform: methanol: ammonia 9.8:0.2: 0.01. Each analysis was repeated three times and the results obtained were subjected to analysis of variance. Mean differences between plant parts were tested for significance ($P < 0.05$) using the Duncan multiple range (Duncan, 1955).

RESULTS AND DISCUSSIONS

The proximate composition of *D. innoxia* in leaf, seed, stem, pod and root is presented in Table 1 while the phytochemical analysis is in Table 2. The proximate analyses indicated that as usual in plant parts, there was a variation in crude protein content which ranged from 2.09 in the root to 17.21% in the leaf. The crude protein of the seed, stem and pod were found to be 13.90, 6.16 and 2.12%, respectively. There was significant difference ($P < 0.05$) in the protein contents of the five morphological plant parts. According to the NRC (1993), crude protein of less than 20% indicates low protein content of that feed stuff. These crude protein results are however comparable with the result of some tropical plant seeds analysed by Ezeagu et al. (2000), who reported that *Diospyno mespiliformis* and *Entandrophrgma angolense* had crude protein contents of 3.46 and 12.34%, respectively. The moisture content which measures the amount of water in the plant also varied with the root having the lowest (3.5%) moisture content while the stem had the highest of 15%. The seed, pod and leaf had 10.00, 8.50 and 7.5% moisture contents respectively. Significant difference ($P < 0.05$) was observed in the moisture contents of the plant parts. According to NRC (1993), moisture content of 5 - 20% (DM) is regarded as high. This indicates that the moisture content of the leaf, seed, stem and pod were high. The result of this investigation is comparable with those obtained by Ezeagu (2000) for *Gliricidia sepium* 6.77%, *Albizu zygia* 7.8%, *Doneillia ogea* 9.86% and *D. mespiliformis* 8.99% but at variance with those obtained for *Lophira lanceolata* seed (2.78%) as reported by Lohlum et al. (2010).

The crude lipid content followed the same pattern with the seed having the highest lipid content of 15.52% while the root had the least (6%). The pod, stem and leaf had 9.0, 8.50 and 7.50%, respectively. The result of the lipid content of this research is in line with the findings of Muhammad et al. (2010) who worked on five medicinal plants with *Valeriana officinalis* having fat content of 14%. Crude fibre, which measures the fibrous component (cellulose, hemicellulose and lignin), was highest in the root 31.72% followed by the stem 29.66%, the pod, leaf and seed had 16.13%, 8.95 and 6.55%, respectively. Crude fibre content was low in the seed, leaf and pod while stem and root had high crude fibre (NCR, 1993).

Total ash was highest in the root (25.71%) while it was lowest in the seed (8.26%). The leaf, stem and pod had 21.59, 19.50 and 16.28%, respectively. Statistical analysis showed a significant difference ($P < 0.05$) in the ash contents of the plant parts. Onwugbuta (2004) recorded 12.71, 8.10 and 6.71% as total ash contents of cowpea seedlings grown under flood and draught conditions. The Nitrogen free extract (NFE) was highest in the pod (47.97%) and least in stem (20.88%). The seed, leaf and root had 46.67, 42.25 and 30.58% respectively; Statistical difference ($P < 0.05$) was observed in in NFE contents of the plant parts. The result of NFE obtained from this research differ from those reported by Onwugbuta (2004), Jimoh and Oladiji (2005), Muhammad et al. (2010) and Lohlum et al. (2010), this difference

Table 1. Mean proximate composition of *D. innoxia* in leaf, seed, stem, pod and root.

	Concentration (%DM)				
Component	**Leaf**	**Seed**	**Stem**	**Pod**	**Root**
Moisture	7.50 (0.79)	10.00 (1.05)	15.00 (1.54)	8.50 (0.85)	3.50 (0.84)
Total ash	16.59 (1.54)	8.26 (0.85)	19.80 (1.54)	16.28 (1.14)	25.71 (1.54)
Crude lipid	7.50 (0.95)	15.52 (1.51)	8.50 (0.64)	9.00 (0.77)	6.00 (0.54)
Crude fibre	8.95 (0.75)	6.55 (0.98)	29.66 (1.34)	16.13 (1.59)	31.72 (2.57)
Crude protein	17.21 (1.58)	13.90 (1.54)	6.16 (1.25)	2.12 (0.95)	2.09 (0.83)
Nitrogen free extract (NFE)	42.25 (3.57)	46.67 (3.61)	20.88 (1.42)	47.97 (3.55)	30.58 (2.74)

(Standard error in parenthesis for three replicates, n=3).

Table 2. Phytochemical screening of *D. innoxia* leaf, seed, stem, pod and root.

Chemical compound	**Leaf**	**Seed**	**Stem**	**Pod**	**Root**
Atropine	+++	+++	++	+	+
Scopolamine	+++	+++	+	+	+
Saponins	+++	+++	+++	+++	++
Flavonoids	++	++	+	+	+
Cardiac glycosides	++	++	+	+	+
Essential oils	++	+++	+	+	+
Phenols	++	++	+	+	+
Tannins	-	-	-	-	-
Coumarins	-	-	-	-	-
Carboxylic acid	-	-	-	-	-
Valepotriates	-	-	-	-	-

Key: + = present, - = absent.

may be due to difference in plant species and environmental conditions.

The phytochemical screening of *D. innoxia* (Table 2) showed the presence of atropine, scopolamine, essential oils, saponins, flavonoids, phenols, as well as cardiac glycosides; while tannins, coumarins, carboxylic acid and valepotriates were absent.

The findings of the phytochemical analysis of this research indicated the presence of some active drug compounds (atropine and scopolamine), which have sedative, anaesthetic as well as medicinal potency as evidenced in the various uses of *D. innoxia.* Okeke, (1998) reported the use of *D. innoxia* fruit extract in Benue State of Nigeria by young men to sedate girls. Saponins are glycoside components often referred to as “natural detergent” because of their foamy nature (Seigler, 1998). Saponins have been known to posses both beneficial and deleterious properties depending on its concentration in the sample (Seigler, 1998; Oakenful and Sidhu, 1989). Seigler (1998) reported that saponins have anticarcinogenic properties, immune modulation activities and regulation of cell proliferation as well as health benefits such as inhibition of the growth of cancer cells and cholesterol lowering activity.

Flavonoids have been reported to exert multiple biological effects including antibacterial, antiviral, antitoxic

and anti-inflammatory activities (Cook and Samman, 1996). Many of these alleged effects of flavonoids have been linked to their known functions as strong antioxidants, free radical scavenger and metal chelators (Nakayama et al.1993).

The positive effects of glycosides and cardiac glycosides are not common but their toxic effects include decreased heart rate, decreased sympathetic activity and decreased systemic vascular resistance (Seigler, 1998). The presence of some of these antinutrients could however be reduced by various processing techniques (Elegbede, 1998). The concentrations of atropine, scopolamine, essential oils, saponins, flavonoids, phenols, and cardiac glycosides in *D. innoxia* need therefore be ascertained.

Conclusion

The phytochemical screening of the *D. innoxia* revealed the presence of important pharmacological bioactive substances as well as medicinal and nutritional potentials in the leaf, seed, stem, pod and root. It is thus suggested that more studies on concentrations of active ingredients, anti nutritional factors and toxicity level be carried out.

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